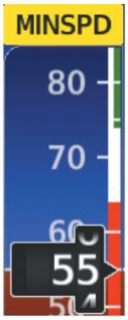
27 Oct 2023

SR-20/22 Engine Failure Decision Making

There I was… Cruising at a comfortable 8500 feet on a nice VFR day in Florida in my Cirrus SR aircraft. Suddenly, the engine RPM drops and my heart sinks at the same cadence. Holy cow, is this really happening? An engine failure in a well-maintained aircraft is actually an uncommon occurrence. However, we as instructors must ensure we and our students are prepared for the worst and are comfortable with the upcoming rapid, life-saving decisions that must occur over the next few minutes.

The old adage of "ABC" (Airspeed, Best Field, Corrective Action) still applies to the Cirrus SR line of aircraft, nuanced however with the fact the reliable CAPS system is our last measure of ensuring crew and passengers walk away uninjured. This discussion is for those moments leading up to the CAPS deployment to help us in our decision making to regain power, save the aircraft if within a safe distance of an airfield, or ensure a timely rescue in the event we need to pull the CAPS handle.

Airspeed – Set best glide speed (Vg) approximately 96 KIAS - If the engine fails, the first step is to establish the aircraft at the best glide speed to maximize our time airborne and extend our range for a potential airfield landing. The glide speed for the SR series is annotated as a "G" on the speed tape and somewhere around 96 knots for the SR-20/22. Since we are flying on auto pilot the majority of the time in cruise, we need to understand the steps necessary to have the aircraft efficiently fly best glide speed for us. With a total power loss, the airspeed decreases rapidly, and the airplane may decelerate below the glide speed before the auto pilot is programmed for the descent. With the auto pilot in ALT, if the airspeed decays below the minimum speed for safe flight (see figure), an aural "AIRSPEED" alert will sound every five seconds and a red "UNDERSPEED PROTECT ACTIVE" annunciation will appear to the right of the Vertical Speed Indicator. A slight pitch down force will occur and continue until the aircraft reaches a pitch attitude at which IAS equals the IAS at which stall warning turns off, plus two knots. This speed is below the best glide speed. In order to have the autopilot descend *at* glide speed, we must set a lower altitude and give the autopilot a decent mode, either VS or FLC. FLC in this case would work best since we have a target speed for the descent, i.e. best glide (~96 kts).



The most efficient steps to set up the autopilot to fly at best glide (Vg), is:

1) Altitude Selector Decrease (spin it down)
2) FLC button select,
3) Adjust the FLC speed to 96,
4) refine the Altitude selected to 2000' AGL.

If you're unsure of the local elevation, you can obtain it by pushing the top left cursor knob (zoom knob) on the MFD control panel. This will display a small arrow cursor and a white box in the upper left corner of the MFD showing the elevation at the cursor position.

Best Field - After the Autopilot is set for the descent, we need to arm the navigation to fly towards the nearest airport. The quickest method for this is to use the PFD, lower right soft-key, "nearest" button, then select the Direct button (lower right of PFD), ENT, ENT. The GPS is now set to fly direct to the nearest airport (hard and/or soft surface as set up in the user pages). If in NAV mode, the aircraft will turn immediately. If in HDG mode, you must select the NAV button on the autopilot to begin turning towards the nearest airport. Now that the airplane is flying at best glide ("A" for Airspeed), towards the nearest airport ("B" for Best Field), you can begin troubleshooting the engine ("C" for Corrective Action).

Corrective Action - Fuel, Oil, Spark, Air (FOSA) will cover the main items to troubleshoot the engine. Fuel – Boost pump on, Switch fuel tanks, Mixture Rich, Vary the throttle. These steps should provide an adequate fuel/air ratio for the engine to run provide all the other requirements are met. Oil – Not much you can do to change, but you can see if the oil pressure dropped to zero. If it did, your first indication may have been engine running at a higher than normal RPM or a surging RPM. If the propellor governor is starved for fuel, the propellor will go to a low pitch (high RPM) setting. Spark – check the MAGS just like you would on the ground, R, L, Both. If the engine runs smoother on one of the MAGS, leave it there… if no change, put the key back in Both. Air – Pull the red alternate air source knob near the pilot's right shin. This will provide the engine with adequate air in case the intake was clogged by debris (bird, ice, etc.).

Completing the ABC's should only take 60-90 seconds to complete. Once the A, B, C's are complete, and there is no change in the engine health, make your radio call to ATC, declare an emergency, squawk 7700 and continue to troubleshoot as you determine whether or not your glide will take you to a suitable landing surface.

Preparing for CAPS or Landing

When you reach 200' above the altitude selected (which should be set to 2000' AGL), you will hear a "Ding" indicating you are nearing your level off altitude. It is at this moment, you need to ask yourself two questions… 1) Can I land? and 2) Should I land? If the answer is YES to BOTH of these questions, kick off the autopilot and use the High Key (2500' above the airfield) Low Key (1500' abeam the touchdown point) numbers to continue to land the aircraft safely.

If the answer is NO to EITHER of these questions, prepare for CAPS deployment. The autopilot will continue to descend at Vg until level off, then it will slow down rapidly towards the stall speed. You must either set a lower altitude or kick of the autopilot in order to continue to descent at best glide. We recommend turning the autopilot OFF to align the aircraft towards/over a field of intended CAPS landing. When aligning the aircraft towards/over a clearing or away from congested areas, the absolute minimum altitude you should accept is 1500' AGL. When the aircraft is aligned, or you reach 1500' AGL, follow the flow "Blue, Red, Red" to deploy the CAPS.

Blue – turn on the LVL function of the autopilot. This will level the wings and stabilize the aircraft for the CAPS pull.

Red – Pull the Mixture to OFF. This will cut all fuel flow to the engine and ensure the engine is fully stopped during CAPS deployment.

Red – Pull the CAPS handle. Remove the cover, use two hands to apply approximately 45 lbs of downward force on the handle by performing a "chin up" pull with both hands.

The aircraft will pitch up approximately 10 degrees nose high, then approximately 70 degrees nose low before settling at about 10 degrees nose low for the parachute ride to the surface. With the aircraft now hanging safely in the parachute, make any final radio calls to ATC/Guard, then continue the shutdown procedures of the airplane. Turn all switches off, turn off the Mags, turn the fuel selector to OFF, and open one of the doors for impact. The seats are designed to crush on impact to reduce back injuries. Have your passengers secure their safety belts for impact. The impact approximates being dropped from around the height of a basketball backboard.

Landing at an airfield:

If the answer is "Yes" at 2000' agl, and you are in a position to SAFELY land at an airfield, use the "High Key – Low Key" technique to make the landing.

High Key (2500' AGL) - defined as the aircraft aligned with the landing runway, and 2500' AGL over the numbers. From this point you should be able to execute a normal 30 deg bank turn and lose approximately 1000' to the turn to downwind and the Low Key position.

Low Key (1500' AGL) - defined as ABEAM the touchdown point at 1500' agl at normal pattern distance, appx ¾ mile. From this position, you should be able to manage the glide with flaps in order to touchdown 1/3 down the runway as the desired landing point. Play the bank angle and flaps in order to reach the touchdown point.

Altitude loss at glide:

- At 30 deg bank, on glide speed, you lose appx 1000 feet per 180 deg turn.
- At 45 deg bank, on glide speed, you lose appx 500 feet per 180 deg turn.

Example: If you're at the High Key position but at 2000' agl (500' low) your initial turn should be at 45 deg bank in order to make the Low Key position. You'll be a little tighter to the runway (good problem to solve), but you can be closer to the Low Key position to better manage the energy to the runway.